

**What Is Claimed Is:**

1 1. A substrate, comprising:

2 a) a silicon carbide layer having a dielectric constant less than 7.0 and deposited on  
3 the substrate; and

4 b) a first dielectric layer deposited on the silicon carbide layer *in situ* with the  
5 silicon carbide layer.

1 2. The substrate of claim 1, further comprising:

2 a) a silicon carbide etch stop deposited on the first dielectric layer *in situ* with the  
3 first dielectric layer;

4 b) a second dielectric layer deposited on the etch stop *in situ* with the silicon  
5 carbide etch stop.

1 3. The substrate of claim 2, further comprising a silicon carbide anti-reflective coating  
2 deposited on the second dielectric layer *in situ* with the second dielectric layer.

1 4. The substrate of claim 2, further comprising a photoresist deposited on the second  
2 dielectric layer.

1 5. The substrate of claim 1, further comprising a photoresist deposited on the first  
2 dielectric layer.

1 6. The substrate of claim 1, further comprising:

2 a) a silicon carbide anti-reflective coating deposited on the first dielectric layer *in*  
3 *situ* with the first dielectric layer;

4 b) a photoresist layer deposited on the anti-reflective coating.

1 7. The substrate of claim 1, wherein the silicon carbide layer has a dielectric constant of  
2 about 5 or less.

1 8. The substrate of claim 1, wherein the substrate has an effective dielectric constant of  
2 about 5 or less.

1 9. The substrate of claim 1, wherein the silicon carbide layer is produced by a process in a  
2 plasma reactor having a chamber comprising providing an organosilane flow rate of about 30  
3 to about 500 sccm as a silicon and a carbon source and a noble gas flow rate of about 100 to  
4 about 2000 sccm and further comprising reacting the silicon and the carbon in a chamber  
5 pressure range of about 3 to about 10 Torr with an RF power source supplying a power density  
6 of about 4.3 to about 10.0 watts per square <sup>inch</sup> ~~centimeter~~ to the chamber and a substrate surface  
7 temperature of between about 200° to about 400° C.

1 10. The substrate of claim 3, wherein the silicon carbide layer, etch stop, and anti-reflective  
2 coating comprises silicon carbide having a dielectric constant less than 7.0.

1 11. The substrate of claim 3, further comprising selecting the anti-reflective coating having  
2 a thickness that produces a reflectivity of about 7 percent or less.

1 12. The substrate of claim 6, further comprising selecting the anti-reflective coating having  
2 a thickness that produces a reflectivity of about 7 percent or less.

1 13. The substrate of claim 1, wherein the substrate comprises a damascene structure.

1 14. A method of forming a silicon carbide layer on a substrate, comprising:

- 2 a) introducing silicon, carbon, and a noble gas into a chamber;  
3 b) initiating a plasma in the chamber;  
4 c) reacting the silicon and the carbon in the presence of the plasma to form silicon  
5 carbide;  
6 d) depositing a silicon carbide layer having a dielectric constant less than 7.0 on  
7 the substrate in the chamber; and  
8 e) depositing a first dielectric layer *in situ* with the silicon carbide layer.

1 15. The method of claim 14, further comprising:

- 2 a) depositing a silicon carbide etch stop *in situ* with the first dielectric layer;
- 3 b) depositing a second dielectric layer *in situ* with the silicon carbide etch stop.

1 16. The method of claim 15, further comprising depositing a silicon carbide anti-reflective  
2 coating *in situ* with the second dielectric layer.

1 17. The method of claim 15, further comprising depositing a photoresist layer on the  
2 second dielectric layer.

1 18. The method of claim 14, further comprising depositing a photoresist layer on the first  
2 dielectric layer.

1 19. The method of claim 14, further comprising depositing a silicon carbide anti-reflective  
2 coating *in situ* with the first dielectric layer.

1 20. The method of claim 14, further comprising producing a substrate having an effective  
2 dielectric constant of no greater than about 5.

1 21. The method of claim 14, wherein the silicon and carbon are derived from a common  
2 organosilane, independent of other carbon sources.

1 22. The method of claim 14, wherein the silicon and carbon are derived from a common  
2 source, and reacting the silicon and the carbon in the presence of the plasma to form silicon  
3 carbide occurs independent of the presence of a separate hydrogen source.

1 23. The method of claim 14, wherein the silicon and carbon are derived from a common  
2 source and reacting the silicon and the carbon in the presence of the plasma to form silicon  
3 carbide occurs independent of the presence of a separate carbon source.

1 24. The method of claim 14, wherein the substrate comprises a damascene structure.

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1 25. The method of claim 14, further comprising selecting an anti-reflective coating that has  
2 a single selected thickness to produce a reflectivity of about 7 percent or less when an  
3 underlying dielectric layer below the anti-reflective coating has a thickness from about 5000 Å  
4 to about 10000 Å.

1 26. A method of *in situ* deposition of silicon carbide on a substrate, comprising:

- 2 a) depositing a silicon carbide barrier layer on the substrate;  
3 b) depositing a first dielectric layer on the barrier layer *in situ* with the barrier  
4 layer;  
5 c) depositing an etch stop on the first dielectric layer *in situ* with the first dielectric  
6 layer;  
7 d) depositing a second dielectric layer on the etch stop *in situ* with the etch stop;  
8 and  
9 e) depositing an anti-reflective coating on the second dielectric layer *in situ* with  
10 the second dielectric layer.

1 27. The method of claim 26, wherein the barrier layer, etch stop, and anti-reflective coating  
2 comprises silicon carbide having a dielectric constant less than 7.0.

1 28. The method of claim 26, further comprising producing a substrate having an effective  
2 dielectric constant of no greater than about 5.

1 29. The method of claim 26, further comprising removing a contaminant on a substrate  
2 layer by:

- 3 a) introducing a reducing agent comprising nitrogen and hydrogen into a chamber;  
4 b) initiating a reducing plasma in the chamber;  
5 c) exposing an oxide on the substrate layer to the reducing agent.

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